16. FISH FRY PREDATION BY WHITEBREASTED AND PIED KINGFISHERS AT A NURSERY POND

Whitebreasted kingfisher (*Halcyon smyrnensis*) and kingfisher (*Ceryle rudis*) are among the common waterbirds of Punjab frequenting inland waterbodies. These birds have been reported to consume not only fish fry and crustaceans of commercial value but also frogs, toads and tadpoles, and are therefore considered harmful at fish nurseries (Mason and Lefroy 1912, Ali and Ripley 1970, Mukherjee 1975). However, no information on the extent of predation by these kingfishers on fish fry is available. The observations on this aspect were recorded at a nursery pond (12 × 18 m) of a private fish farm at village Purain *c.* 30 km west of Ludhiana (30° 56′ N, 75° 52 E and *c.* 247 m above mean sea level), Punjab, India.

The eggs of common carp *Cyprinus carpio* collected from a stocking pond were periodically added to the nursery pond during March-April, 1985 for culturing the species. However, carnivorous Indian murrel (*Channa punctatus*) entered the nursery pond from an adjoining unmanaged pond, bred there and consumed common carp almost totally. On 30 June, when the fish fry were sampled from the nursery pond, common carp had been reduced to only about 2% of the total catch and the rest of the fish fry were all Indian murrel.

During May, a flock of kingfishers was observed feeding on fish fry from the nursery pond. It was comprised of two adult and two fledgeling whitebreasted kingfishers and two adult pied kingfishers. One adult whitebreasted kingfisher was, however, shot by the owner of the fish farm prior to the recording of observations. To estimate fish fry mortality due to kingfishers, we observed the birds for nine days (22 through 30 June). Every day, observations were made for one hour from 5.45 to 6.45 a.m. (which was the period of their maximum feeding activity) and the total number of feeding attempts made by kingfishers and number of successful attempts were recorded. The number of captured fish fry fed to the fledgelings by whitebreasted kingfisher was also recorded. The birds were observed from a distance of *c.* 7.5 m without using any hide since they seemed not to be shy of our presence. The length of fish fry at the end of observation period ranged between 11 and 46 mm and averaged 18.66±10.04 mm (mean± s.d., N=53).

On an average, whitebreasted kingfisher made 56.43 feeding attempts per hour and 78.73% of these attempts were successful (Table 1). Since each time this kingfisher caught one fry, the number of fry removed from the pond was 44.45 per hour. There was no significant difference in the number of fry fed to the fledgelings and those eaten by the adult whitebreasted kingfisher ($t=0.085$, $P>0.05$). Hence, half of the fry captured by the adult were fed to the young and half eaten by itself. Pied kingfisher made 10.81 feeding attempts per hour, 66.51% of which were successful (Table 1). In one hour, this kingfisher captured and devoured 7.19 fish fry.

The number of feeding attempts per hour and the number of successful attempts (i.e., the number of fish fry captured) were significantly higher in case of whitebreasted than pied kingfisher ($t=5.784$, $P<0.001$ for number of feeding attempts, and $t=5.8263$, $P<0.001$ for number of successful attempts). Whitebreasted kingfisher captured more than six times the number of fry captured by pied kingfisher. Since half of the captured fry were fed by the whitebreasted kingfisher to its fledgelings, it may be concluded that an adult of this species consumed nearly three times the num-

TABLE 1

RATE (NO./HR) OF KINGFISHER PREDATION ON FISH FRY

Date	Whitebreasted Kingfisher				Pied Kingfisher	
	Total attempts	Successful attempts	Fry fed to young	Fry eaten by adult	Total attempts*	Successful attempts*
22 June	81	62	23	39	28	20
23 June	80	62	28	34	12.5	7
24 June	Birds did not feed because of strong wind					
25 June	40	33	16	17	12	7
26 June	NB	NB	NB	NB	3.5	2.5
27 June	67	55	29	26	2	2
28 June	51	44	24	20	13	8.5
29 June	50	40	25	15	11.5	8
30 June	26	15	9	6	4	2.5
Mean	56.43	44.43	22.00	22.43	10.81	7.19
SD	20.57	17.06	7.12	11.41	8.30	5.82

*Mean of attempts by two adults.
NB = No bird was recorded.

ber of fry consumed by an adult pied kingfisher. Therefore, whitebreasted kingfisher seems to be relatively more injurious to fish fry.

The kingfishers used to start feeding at dawn as soon as they were able to see the prey. They continued feeding with full activity for about an hour, hence we preferred to record observations during this period. The feeding activity progressively reduced in intensity as the day advanced and birds did not feed at all during the hot hours of midday. The peak feeding activity during early morning seems to be due to two reasons: (i) the birds having spent the whole of the night without feeding have to satisfy their hunger early in the morning, and (ii) maximum depletion of dissolved oxygen occurs during this period which forces the fish fry to come to the surface of water and fall an easy prey to kingfishers. During the period of observation, the fledgelings of whitebreasted kingfisher never tried to hunt. They only perched on a *Eucalyptus tereticornis* tree on the bank of the pond. The fledgelings had just left their nest-hole made in the earthen bank of an adjoining rearing pond when we started recording observations. Kingfishers did not attempt hunting whenever the wind blew at a high speed, as for example on 24 June (Table 1). This might be because fish do not come to the water surface since water currents and speedy wind increase the dissolved oxygen content of water. Moreover, kingfishers may not be able to aim accurately at the prey during strong wind.

We can make a very rough estimate of the extent of fish fry mortality due to kingfisher predation. Even if we assume that the kingfishers fed only for one hour (i.e. the period of observation) each day, they would consume about 59 ($44.43 + 7.19 \times 2 = 58.81$) fish fry a day. At this rate, the number of fry con-

sumed by them in 61 days of May and June would be 3599. In view of our assumption, however, the actual fry mortality would be much higher than this estimate since the birds also fed during other parts of the day, although not as vigorously as in the early morning.

DEPARTMENT OF ZOOLOGY,
PUNJAB AGRICULTURAL UNIVERSITY,
LUDHIANA - 141 004,
December 7, 1985.

RANJIT S. JIOR
MANJIT S. DHINDSA

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17. PREDATION OF GOLDENBACKED WOODPECKER, *DINOPIUM BENGHALENSE* (LINN.) ON CARDAMOM SHOOT-AND-FRUIT BORER, *DICHOCROCIS PUNCTIFERALIS* (GUENE)

On 16 September, 1984 a Goldenbacked Woodpecker was sighted predating on the cardamom shoot-and-fruit borer, *D. punctiferalis* in Mudigere, Chickamagalur. The woodpecker with its powerful bill chiselled out shoot peelings, located the borer larvae inside the shoot tunnel, and gulped them down. The bird flew to the next cardamom clump. The woodpecker located the borer-infested cardamom sucker and using the black, stiff tail feathers as a brace, held it tight by claws. The bird tapped on the shoot and again began chiselling away shoot peelings.

Of the 60 cardamom plantations surveyed from 1984 to 1986 in Chickamagalur District, Karnataka, the activity of the woodpecker was recorded only in six (10%). On an average, the woodpecker devoured 22.80 per cent of borer larvae (Table 1). The survey indicated that the woodpecker's predatory activity was not found in plantations where —

(a) Pesticides were regularly used and/or

(b) Old trees of species of *Artocarpus, Terminalia, Albizzia, Acacia, Bombax, Sapindus, Cinnamomum, Machilus, Garyga, Alstonia, Dipterocarpus, Elaecarpus* and *Cettis* were absent. The woodpecker's predatory activity was also not recorded in plantations where trees of mostly one species (e.g. *Erythrina lithosperma*) were raised to

TABLE 1

WOODPECKER PREDATION ON CARDAMOM BORER IN SOME AREAS OF CHICKAMAGALUR

Date	Area	Cardamom clumps showing woodpecker predation on borer (%)
16-ix-1984	Arahally	12.5
2-viii-1985	Makhonhally	6.0
4-viii-1985	Hosagiri	15.0
14-ix-1985	Kotegehar	21.0
8-x-1985	Mudigere	31.0
5-vii-1986	Goudahally	51.0